

Advanced Amphibious Assault Vehicle



Modeling & Simulation in Acquisition

9 September 97



The Basics

- A MNS describes the needs
- COEA'S bound the choices
- MOE's discriminate between them
- KPP's help derive the physical form
- TEMPS close the loop



Some Issues

- How do you know if “the design” is “right” before you build it ? (squared)
- How do you test things that are critical but can’t be “tested”?
- For things that can be tested, how do you know what it will cost, how long it will take and what you will need?

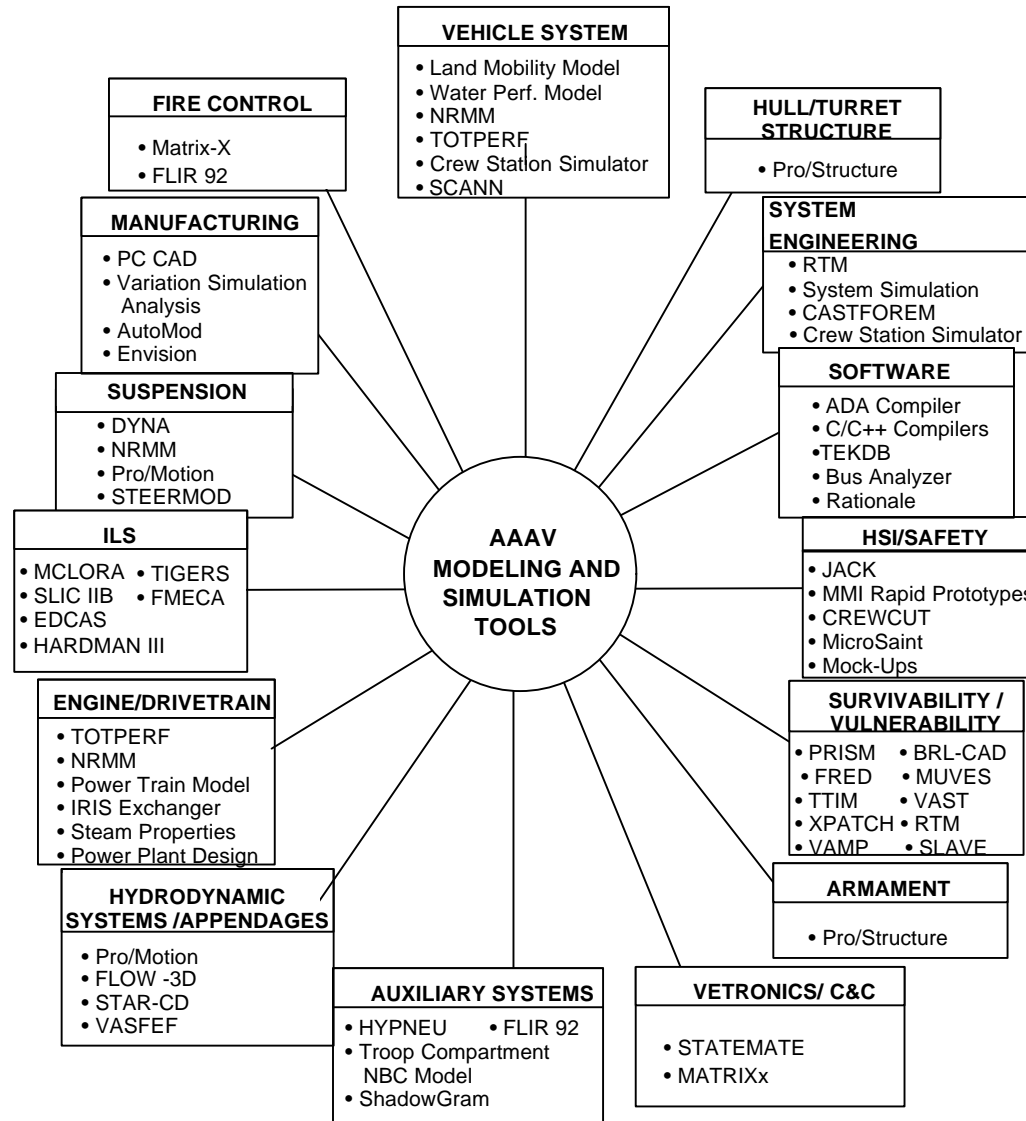


AAAV Model-Test-Model Processes

- Model
 - Model-Test-Model process working in development of AAAV design
 - Model and analyze key performance parameters
 - Test subsystem/component design alternatives with hardware assets
 - Analyze test results to update models; iterate design
 - Utilize M&S to plan and focus Developmental/Operational Testing
- Test AAAV Design
 - PD/RR Prototypes
 - Development Testing
 - Early Operational Testing
- Model
 - Utilize test data to improve design and update models to initiate E&MD feed Model-Test-Model process



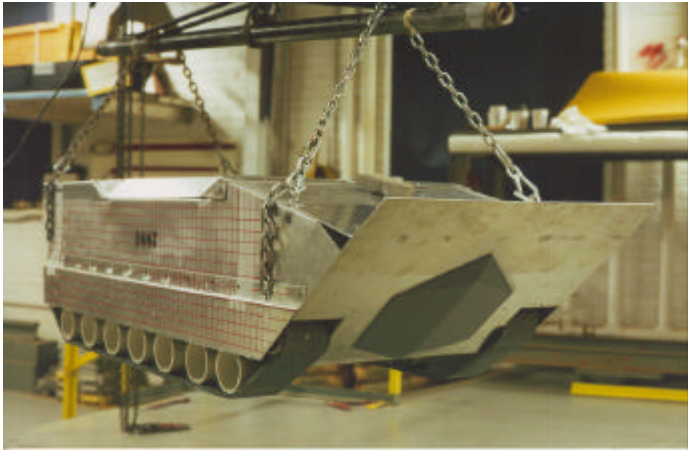
AAAV Modeling and Simulation Tools





AAAV Water Mobility

Model - Test - Model Example



AAAV Unpowered model (1/5 scale)



Hydrodynamic Test Rig (4/5 Scale)



Remote Controlled Craft (1/4 scale)



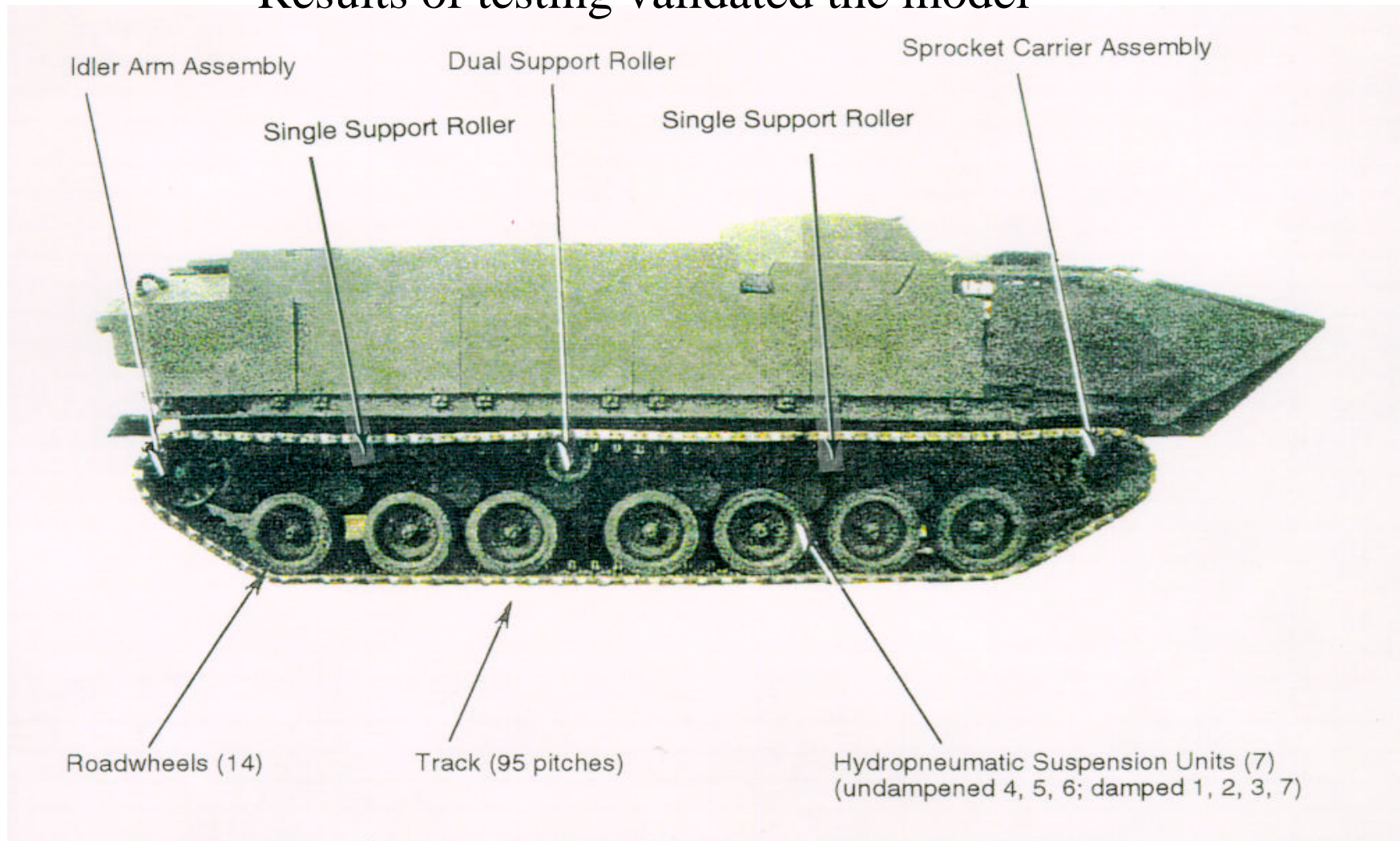
Waterjet Test Rig



ATR Suspension Configuration

ATR tested at Aberdeen Proving Grounds

-Results of testing validated the model



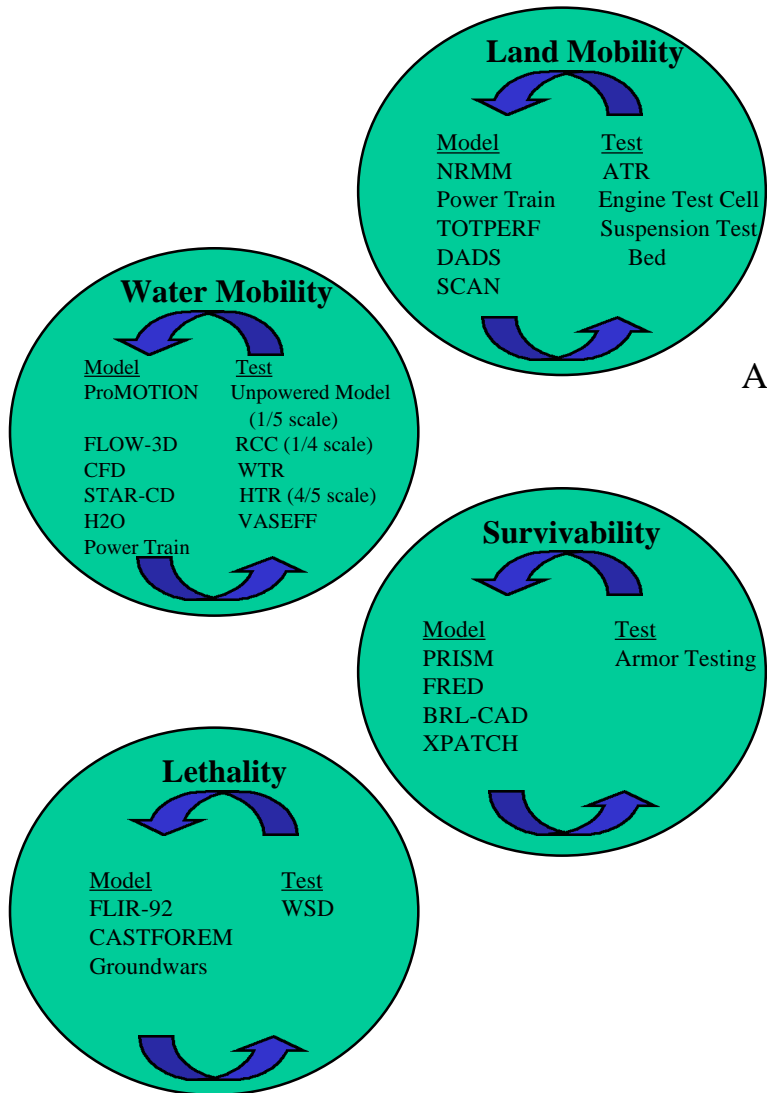


Program Development/Risk Reduction

Model

Test

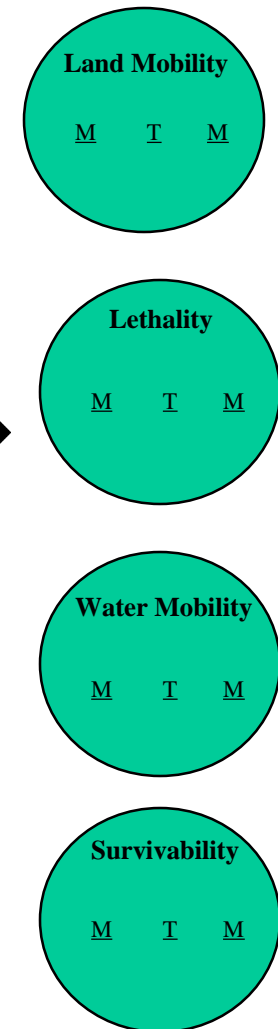
Model



AAAV Design



PDRR Prototypes
Development Testing
Early Operational Assessment

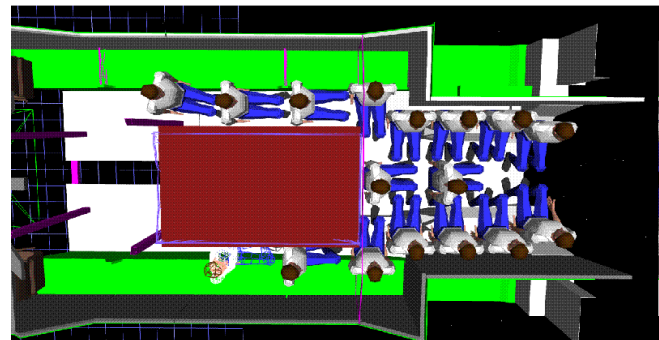
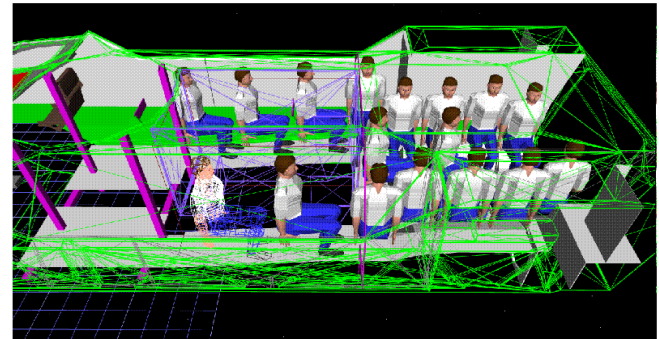
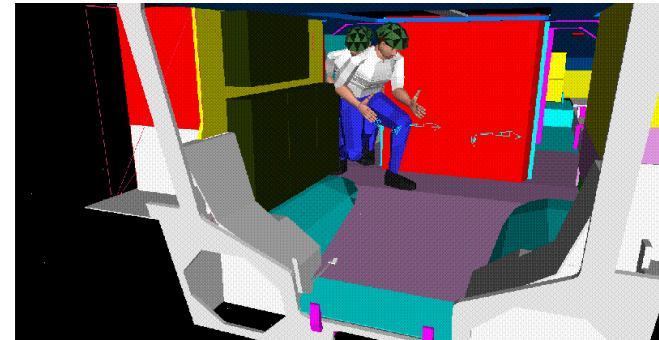




Model - Test - Model

- Development of design via user juries allows early user feedback (i.e. early O.T.)
 - User juries
 - JACK Modeling
 - Physical Mock Up
- 99% Design solution

Jack Modeling





Modeling & Simulation in Operational Testing (O.T.)

- Combined Arms and Support Task Force Evaluation Model (CASTFOREM)- is a force on force, stochastic systemic model of combined arms conflict validated and used by the US Army.
- CASTFOREM was used by DRPMAAA to perform trade studies on combat effectiveness, cost and weight using specific Measures of Effectiveness (MOE) as criteria.
- Many operational scenarios were used with CASTFOREM based on the Defense Planning Guidance (DPG).
- Marine Corps. Operational Test and Evaluation Activity (MCOTEA) will determine which operational vignettes of the overall CASTFOREM analysis will be tested operationally.
- Program Definition and Risk Reduction (PDRR) lessons learned from O.T. will be applied to IOT&E



Modeling & Simulation in Operational Testing (O.T.)

- Operational Test Planning with the testers will be performed using vignettes from the CASTFOREM analysis.
- Model - Test - Model will be applied
- CASTFOREM and the AAAP Crew Station Simulator (Marine in the loop) will be used extensively to
 - plan, and dry run the vignettes for O.T.
 - determine precise O.T. scenarios
 - train O.T. testers
- O.T. conducted
- Results of O.T. compared to CASTFOREM model and simulations performed
- CASTFOREM model and simulations will be optimized based on data from O.T.



BACK UP SLIDES



AAAV Model-Test-Model

- Model-Test-Model Philosophy has been an integral part of the AAAV development process to date
- There is a definite value in Model-Test-Model approach
 - Significant increased fidelity of PD/RR contract design proposals
 - Highly mature vehicle design for PD/RR prototypes
 - Smart testing of hardware assets
- Continued Model-Test-Model efforts anticipated throughout vehicle life

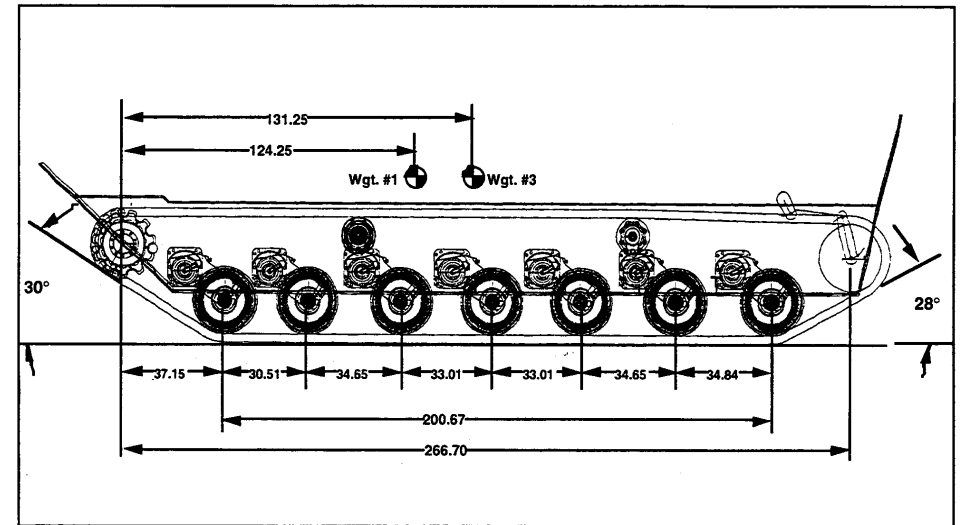
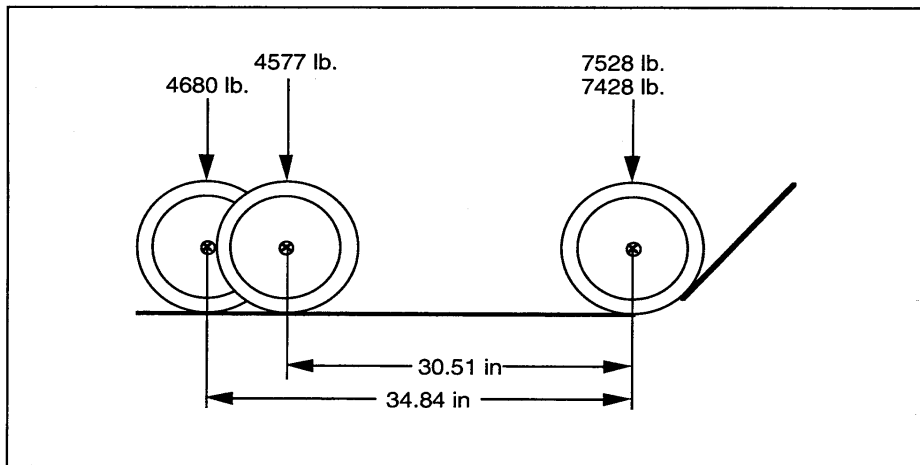


AAAV Land Mobility

Model-Test-Model Example

ATR Design using M&S and Model-Test-Model Philosophy

- Modeled using DADS, NRMM
- Determined Track & Suspension arms placement
- Optimized Roadwheel locations

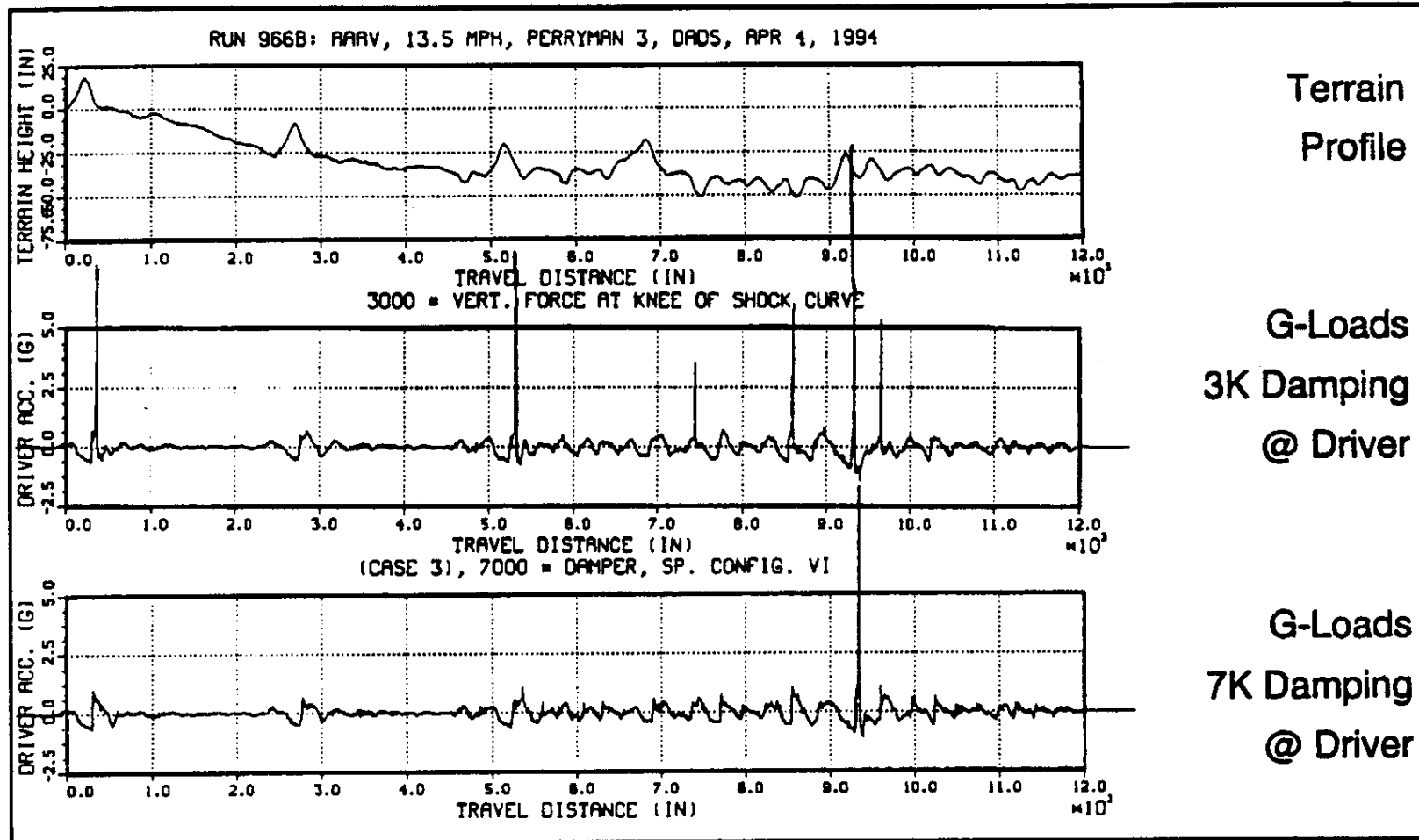


Positioning of #6 Wheel Station
for equal load distribution



ATR Built Based On Optimized Design From Model

DADS Analysis, Perryman 3, 13.5 mph, Weight 3 Condition





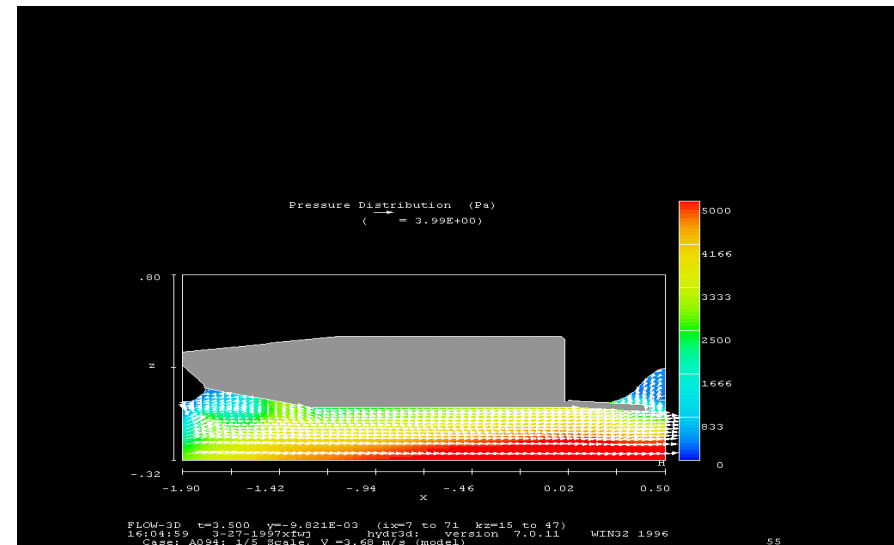
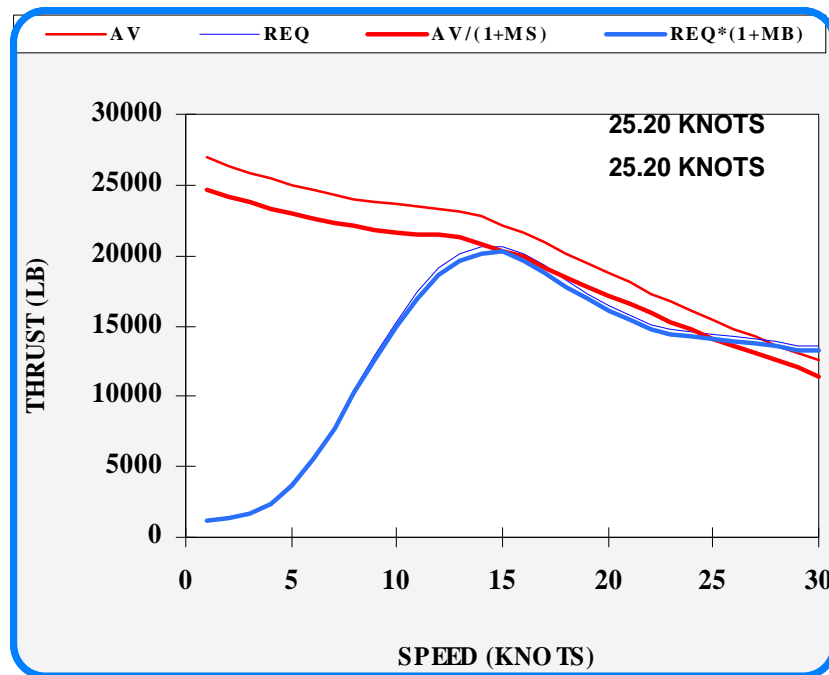
AAAV Water Mobility Model-Test-Model Example

- Hydrodynamics modeled utilizing analytic tools for design development
 - H2O
 - Computational Fluid Dynamics
 - Power Train
- Design alternatives tested on various physical models
 - Remote Controlled Craft (1/4 scale)
 - Unpowered model (1/5 scale)
 - Waterjet Test Rig
 - Hydrodynamic Test Rig (4/5 scale)
 - VasEff
- Test data utilized to optimize models, for next iteration of design maturation



Model - Test - Model In Hydrodynamic Development

H2O computer Model Analysis



Computational Fluid Dynamics



M-T-M in Developmental Testing (DT) and Operational Testing (OT)

- Model many, if not all, of DT/OT Tests
 - Augment testing with synthetic/virtual environment
 - Test problem analysis
 - Interpolation between test cases/events
- Reduce/Eliminate test events
- Reduce scope of needed test events
- Focus critical test resources/assets
- Efficient test planning
- Increase confidence levels for successful test
- Feedback testing data to modeling tools for design maturation, problem resolution, ...



AAAV Modeling and Simulation Value in Developmental and Operational Testing

Focused M&S Investment Early in conjunction with DT/OT Testers Required to Maximize Benefits

- Effective DT/OT Test Planning
 - Test boundaries well defined
 - Planning and allocation of resources
- Reduce DT/OT Costs and Schedule
 - Test smartly with available test assets
 - Reduction in test iterations
 - Focused data collection
- Training of DT/OT Crews



Conclusion

- Model-Test-Model Philosophy has been an integral part of the AAAV development process to date
- There is a definite value in Model-Test-Model approach
 - Significant increased fidelity of PD/RR contract design proposals
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